Center Independent Research & Development: GSFC IRAD

Continued Development of an Airborne System for Direct Validation of Regional Carbon Flux Estimates (CARAFE)

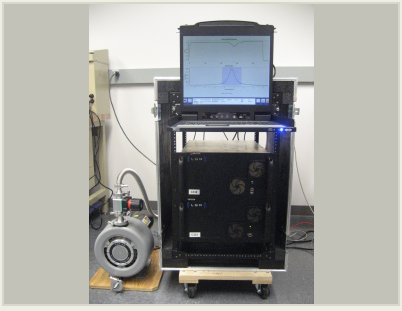
Completed Technology Project (2014 - 2016)

Project Introduction

The overall objective of this project is to build a NASA airborne system for eddy covariance measurements of regional GHG fluxes and to use this system to obtain GHG flux data for a range of ecosystem states and land use regions. These flux measurements are needed to evaluate CO_2 and CH_4 top-down and bottom-up source/sink estimates, including: validation of top-level OCO-2 products and other space-based GHG missions, evaluation and improved parameterization of biogeochemical flux models, and application in airborne science campaigns of opportunity. Development of the payload, adaptation to the airframe, and coordination of the required expert team is necessary to mature the mission concept to a TRL 8-9 level for proposal to Earth Venture-Suborbital 3 (EV-S3) expected in 2017. We are aiming for a flight test in early calendar 2015 that will demonstrate our ability to make the measurements and prove science readiness for EV-S3 and other opportunities.

Anticipated Benefits

The innovative elements in the proposed work are: 1) to modify commercial off-the-shelf (COTS) instrumentation into a new capacity for direct airborne flux measurement and 2) to facilitate development of a GHG flux measurement facility that will provide a new tool for NASA Earth Sciences. Although the eddy covariance technique is well established, historically NASA has had limited involvement in these measurements. Adaption of relatively inexpensive instrumentation for GHG flux measurements is enabled by new commercial instruments using advanced laser detection methods (e.g., Los Gatos Research (LGR), Picarro Inc., etc.). While these instruments are relatively turn-key by design, implementation with airborne eddy covariance is a sophisticated endeavor requiring multiple experienced and specialized personnel – something that NASA is uniquely situated to provide.



The flux instrumentation includes two modified commercial instruments and a fast data acquisition system. The greenhouse gas measurement package is joined with measurements of 3D winds and aircraft flight data on a…

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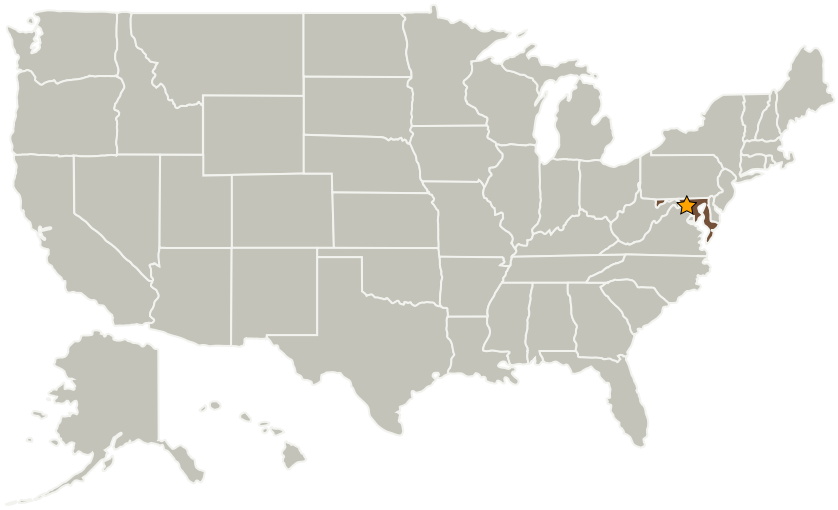
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Project Transitions

October 2014: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

Matthew J Mcgill

Principal Investigator:

Stephan R Kawa

Co-Investigators:

Steven A Bailey
Paul Newman
Glenn M Wolfe

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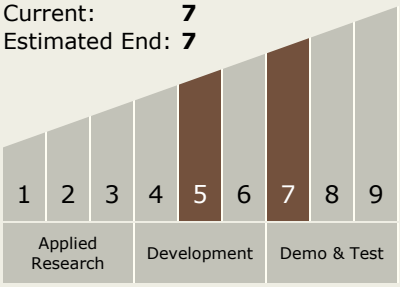
September 2016: Closed out

Closeout Summary: Executive Summary The purpose of the Goddard Space Flight Center's Internal Research and Development (IRAD) program is to support new technology development and to address scientific challenges. Each year, Principal Investigators (PIs) submit IRAD proposals and compete for funding for their development projects. Goddard's IRAD program supports eight Lines of Business: Astrophysics; Communications and Navigation; Cross-Cutting Technology and Capabilities; Earth Science; Heliophysics; Planetary Science; Science Small Satellites Technology; and Suborbital Platforms and Range Services.Task progress is evaluated twice a year at the Mid-term IRAD review and the end of the year. When the funding period has ended, the PIs compete again for IRAD funding or seek new sources of development and research funding or agree to external partnerships and collaborations. In some cases, when the development work has reached the appropriate Technology Readiness Level (TRL) level, the product is integrated into an actual NASA mission or used to support other government agencies. The technology may also be licensed out to the industry.The completion of a project does not necessarily indicate that the development work has stopped. The work could potentially continue in the future as a follow-on IRAD; or used in collaboration or partnership with Academia, Industry and other Government Agencies.If you are interested in partnering with NASA, see the TechPort Partnerships documentation available on the TechPort Help tab. http://techport.nasa.gov/help

Technology Maturity (TRL)

Start: **5**
Current: **7**
Estimated End: **7**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.4 Environment Sensors

Target Destination

Earth

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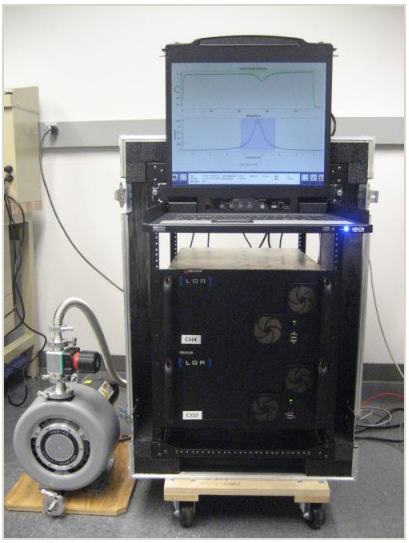
Images



Greenhouse gas flux measurement package
The flux instrumentation includes two modified commercial instruments and a fast data acquisition system. The greenhouse gas measurement package is joined with measurements of 3D winds and aircraft flight data on a central data acquisition computer. *(https://techport.nasa.gov/image/19211)*

Project Website:

http://sciences.gsfc.nasa.gov/sed/